

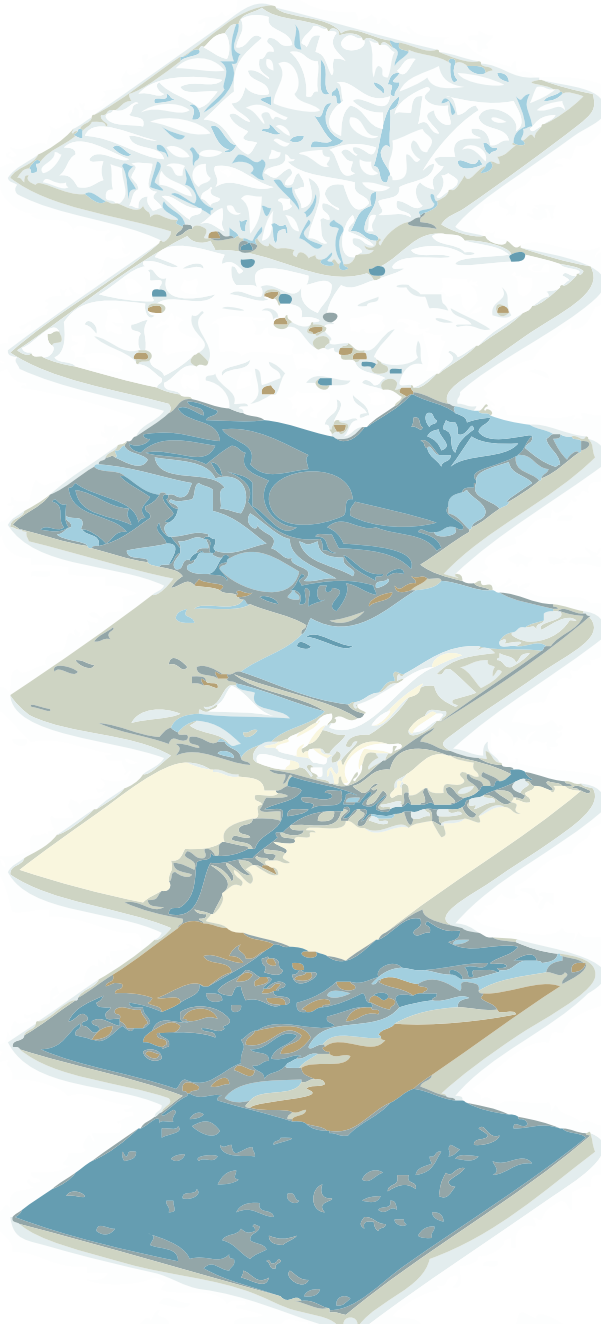
15 Map Layers and GIS

Mapping in the Cloud

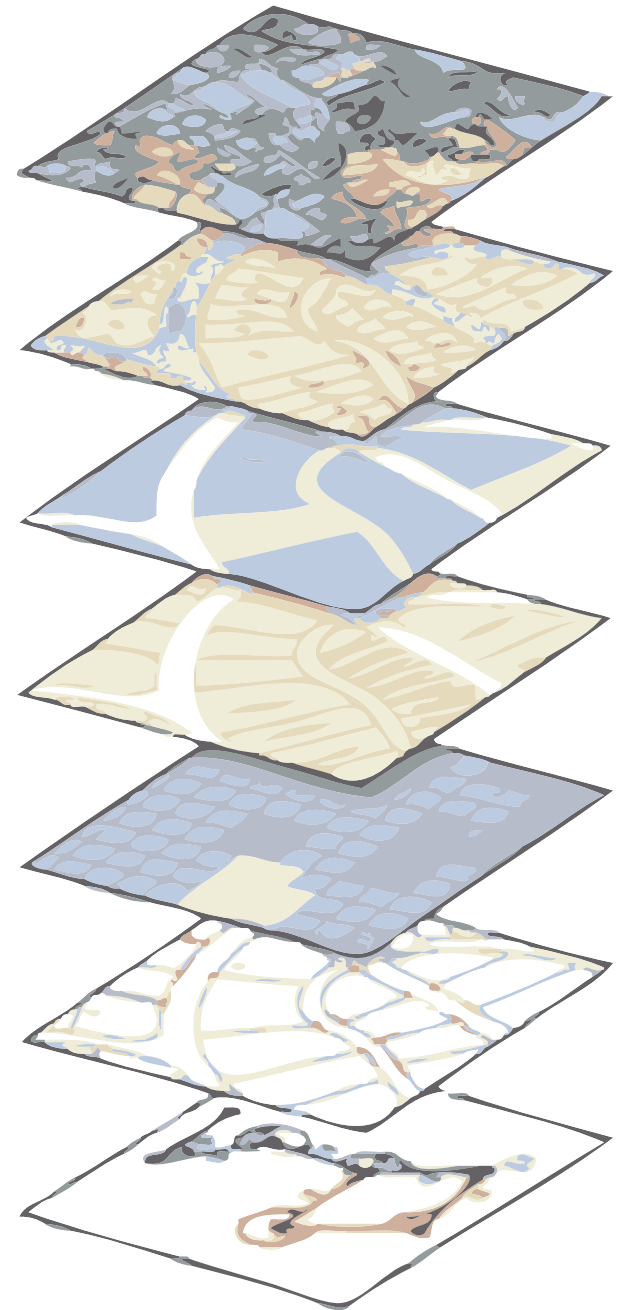
Peterson

GIS

Physical Layers



Human Layers



Raster Overlay

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 4 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 4 | 4 | 1 | 1 | 1 | 1 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 4 | 4 | 4 | 1 | 1 | 2 | 2 | 2 |
| 4 | 4 | 4 | 1 | 1 | 1 | 2 | 1 |

+

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 500 | 500 | 500 | 100 | 100 | 50 | 50 | 50 |
| 500 | 500 | 100 | 100 | 50 | 50 | 50 | 50 |
| 500 | 100 | 100 | 50 | 50 | 50 | 50 | 100 |
| 500 | 100 | 50 | 50 | 50 | 100 | 100 | 500 |
| 100 | 50 | 50 | 50 | 100 | 100 | 500 | 500 |
| 50 | 50 | 50 | 100 | 100 | 500 | 500 | 500 |
| 50 | 50 | 100 | 100 | 500 | 500 | 500 | 500 |

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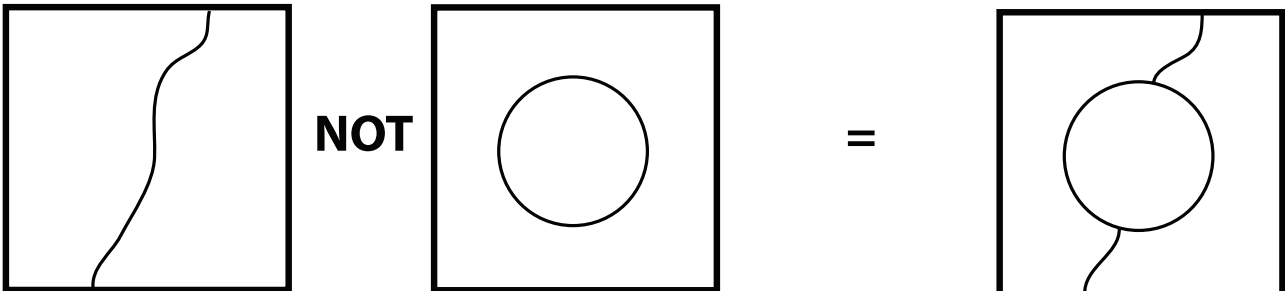
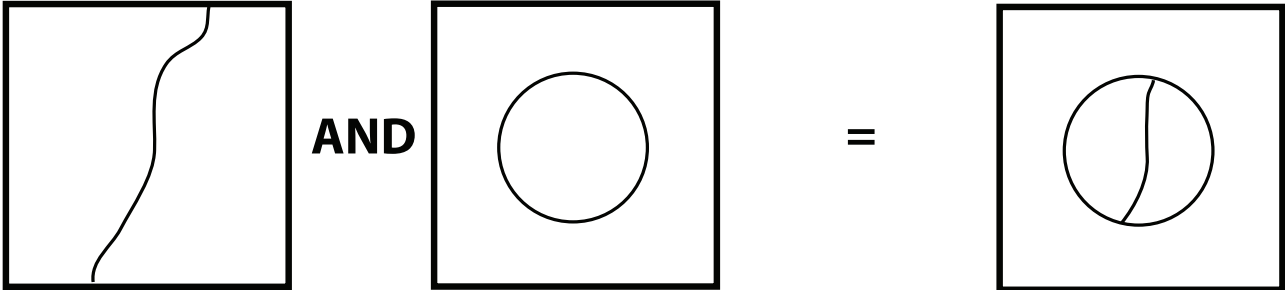
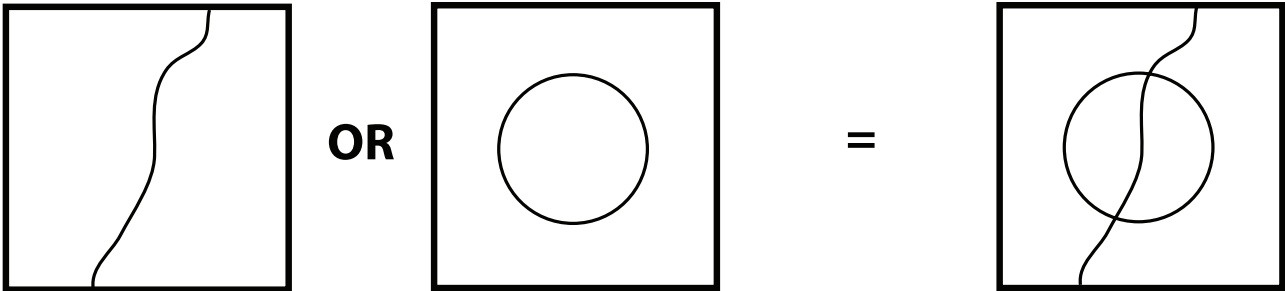
| | | | | | | | |
|--|----|----|----|----|----|--|--|
| | | | | | | | |
| | | | | 51 | | | |
| | | | 51 | 51 | 51 | | |
| | | | | | | | |
| | 51 | 51 | 51 | | | | |
| | | | | | | | |
| | | | | | | | |

1 = Single family
 2 = Multifamily
 3 = Commercial
 4 = Industrial

50 = 50 year-flood
 100 = 100 year-flood
 500 = 500 year flood

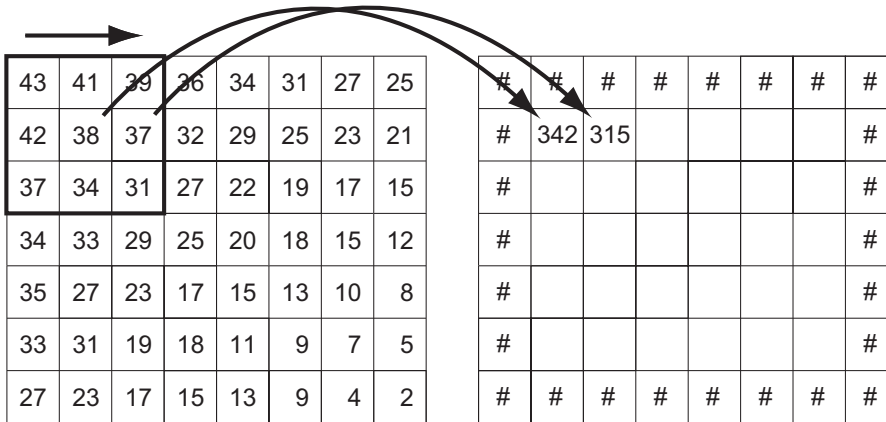
51 = Single family / 50 year-flood

Overlay Types



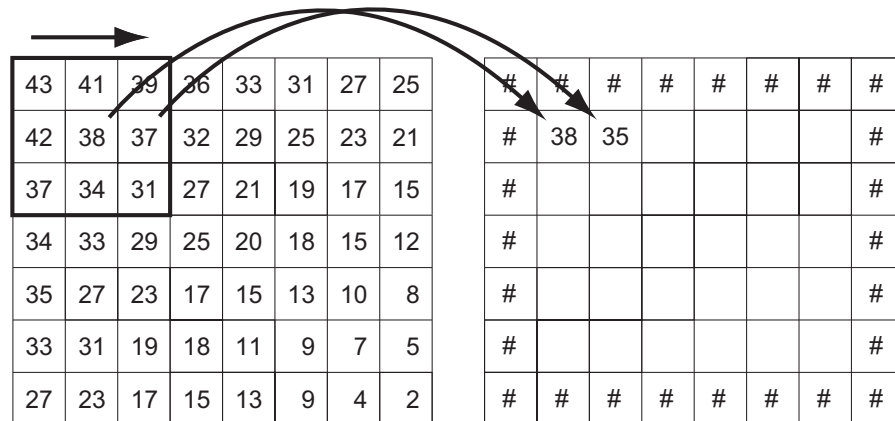
Sum / Mean

SUM



undefined

MEAN



undefined

Masking

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 500 | 500 | 500 | 100 | 100 | 50 | 50 | 50 |
| 500 | 500 | 100 | 100 | 50 | 50 | 50 | 50 |
| 500 | 100 | 100 | 50 | 50 | 50 | 50 | 100 |
| 500 | 100 | 50 | 50 | 50 | 100 | 100 | 500 |
| 100 | 50 | 50 | 50 | 100 | 100 | 500 | 500 |
| 50 | 50 | 50 | 100 | 100 | 500 | 500 | 500 |
| 50 | 50 | 100 | 100 | 500 | 500 | 500 | 500 |

X

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |

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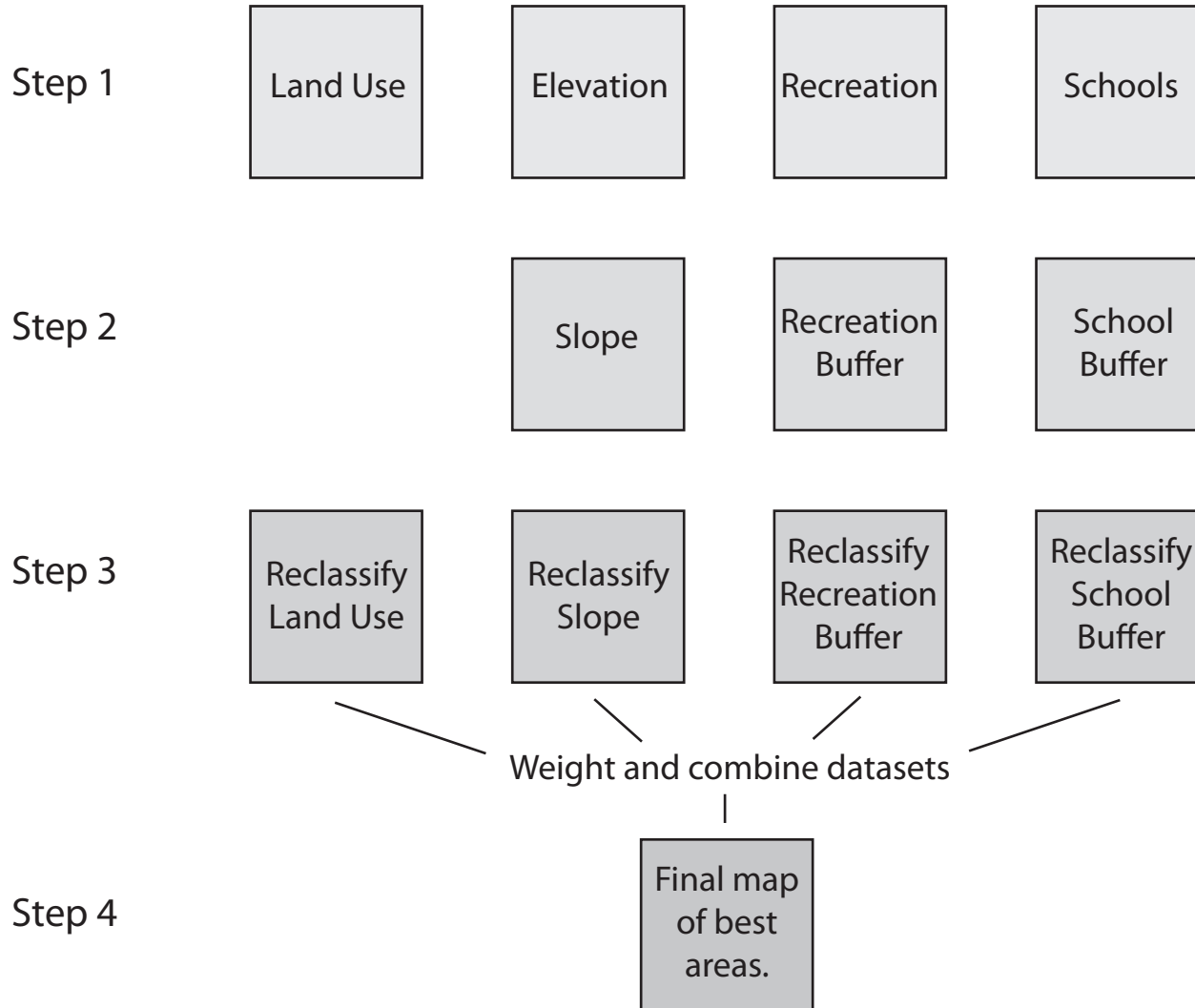
| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 500 | 500 | 0 | 0 | 0 | 0 | 0 | 0 |
| 500 | 500 | 100 | 100 | 0 | 0 | 0 | 0 |
| 0 | 0 | 100 | 50 | 50 | 0 | 0 | 0 |
| 0 | 0 | 0 | 50 | 50 | 100 | 0 | 0 |
| 0 | 0 | 0 | 0 | 100 | 100 | 500 | 0 |
| 0 | 0 | 0 | 0 | 0 | 500 | 500 | 500 |
| 0 | 0 | 0 | 0 | 0 | 0 | 500 | 500 |

50 = 50 year flood
100 = 100 year flood
500 = 500 year flood

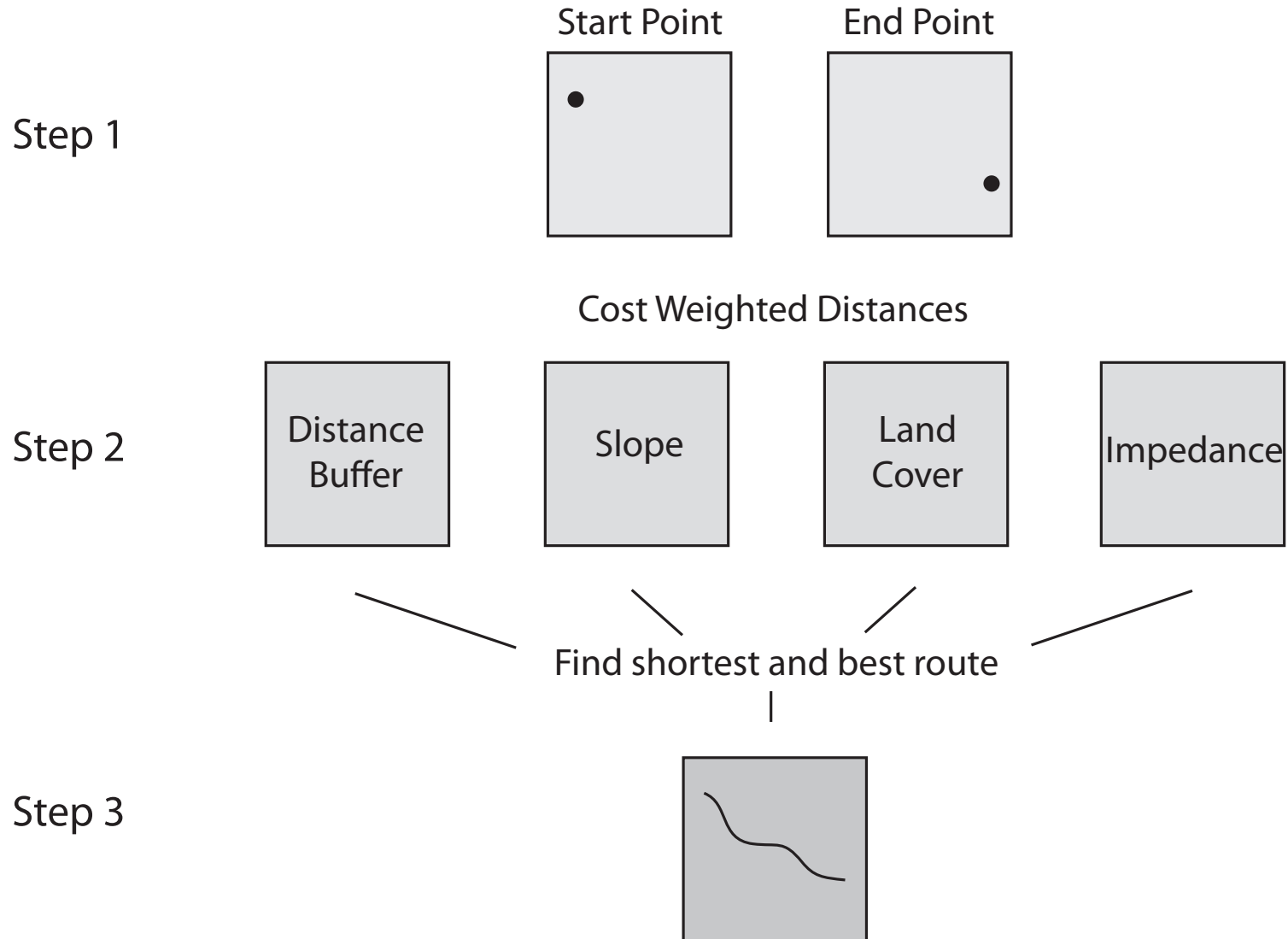
1 = proposed road

result of masking

Best Location



Path of Least Resistance



Slope / Aspect

DEM

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 43 | 41 | 39 | 36 | 34 | 31 | 27 | 25 |
| 42 | 38 | 37 | 32 | 29 | 25 | 23 | 21 |
| 37 | 34 | 31 | 27 | 22 | 19 | 17 | 15 |
| 34 | 33 | 29 | 25 | 20 | 18 | 15 | 12 |
| 35 | 27 | 23 | 17 | 15 | 13 | 10 | 8 |
| 33 | 31 | 19 | 18 | 11 | 9 | 7 | 5 |
| 27 | 23 | 17 | 15 | 13 | 9 | 4 | 2 |

SLOPE

| | | | | | | | |
|---|------|---|---|---|---|---|---|
| # | # | # | # | # | # | # | # |
| # | .495 | | | | | | # |
| # | | | | | | | # |
| # | | | | | | | # |
| # | | | | | | | # |
| # | | | | | | | # |
| # | | | | | | | # |
| # | # | # | # | # | # | # | # |

ASPECT

| | | | | | | | |
|---|----|---|---|---|---|---|---|
| # | # | # | # | # | # | # | # |
| # | 45 | | | | | | # |
| # | | | | | | | # |
| # | | | | | | | # |
| # | | | | | | | # |
| # | | | | | | | # |
| # | | | | | | | # |
| # | # | # | # | # | # | # | # |

undefined

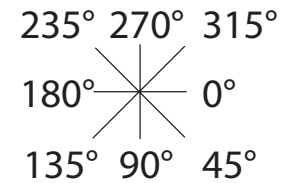
5/14.14 3/10 1/14.14

| | | |
|------|----|------|
| .353 | .3 | .07 |
| .4 | | .1 |
| .07 | .4 | .495 |

4/10 1/10

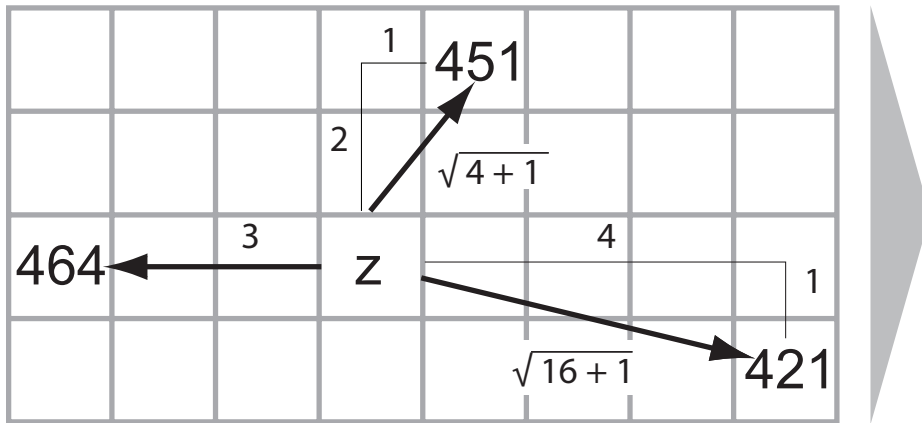
1/14.14 4/10 7/14.14

Slope = rise / run
 Each cell is 10 meters
 Diagonal cells are $\frac{10}{14.14}$ meters ($\sqrt{10^2 + 10^2}$)



Aspect of maximum slope

Interpolation

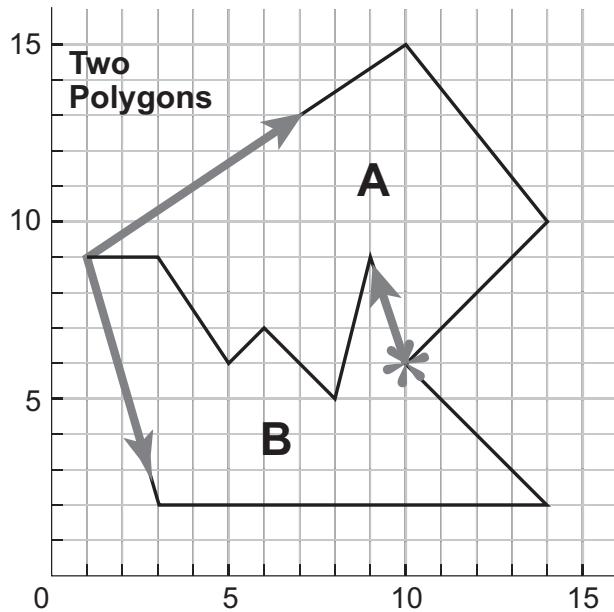


$$Z = \frac{\sum_{k=1}^m Z_k / D_k^2}{\sum_{k=1}^m 1 / D_k^2}$$

$$\frac{\frac{464}{9} + \frac{451}{5} + \frac{421}{17}}{\frac{1}{9} + \frac{1}{5} + \frac{1}{17}} = \frac{166.52}{0.3699} = 450.18$$

Inverse distance squared

Duplication of Points



Polygon A

| x | y |
|----|---|
| 10 | 6 |
| 9 | 9 |
| 8 | 5 |
| 6 | 7 |
| 5 | 6 |
| 3 | 9 |
| 1 | 9 |
| 3 | 2 |
| 14 | 2 |
| 10 | 6 |

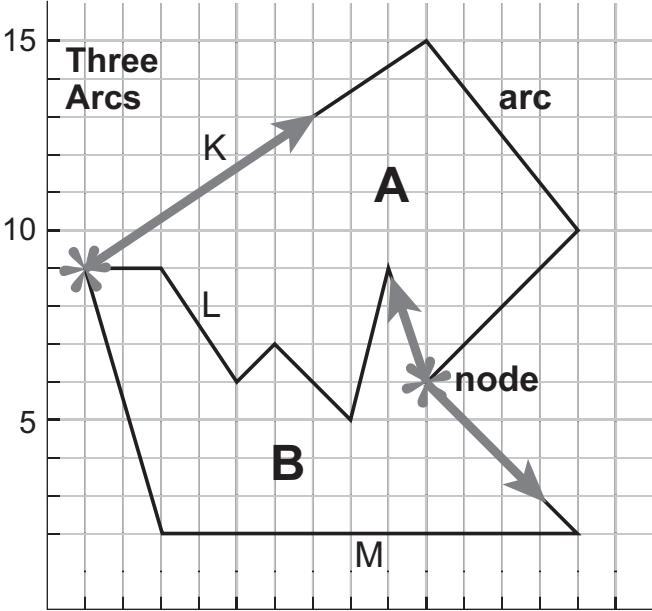
Polygon B

| x | y |
|----|----|
| 10 | 6 |
| 9 | 9 |
| 8 | 5 |
| 6 | 7 |
| 5 | 6 |
| 3 | 9 |
| 1 | 9 |
| 10 | 15 |
| 14 | 10 |
| 10 | 6 |

Duplicated Points

Total Number of Points: 20

Arc / Node



Arc K

| x | y |
|----|----|
| 1 | 9 |
| 10 | 10 |
| 14 | 10 |
| 10 | 6 |

Arc L

| x | y |
|----|---|
| 10 | 6 |
| 9 | 9 |
| 8 | 5 |
| 6 | 7 |
| 5 | 6 |
| 4 | 9 |
| 1 | 9 |

Arc M

| x | y |
|----|---|
| 10 | 6 |
| 14 | 2 |
| 3 | 2 |
| 1 | 9 |

Polygon A:
Arc K, Arc L

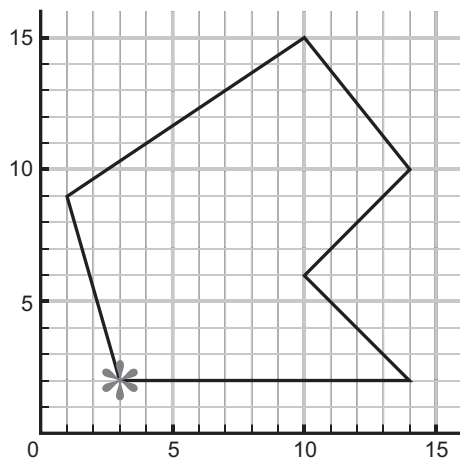
Polygon B:
Arc L, Arc M

Total Number of Points: 15

Scaling

$$x_i = (x_i - x_{\min}) * \text{scaling factor} + x_{\min}$$

$$y_i = (y_i - y_{\min}) * \text{scaling factor} + y_{\min}$$

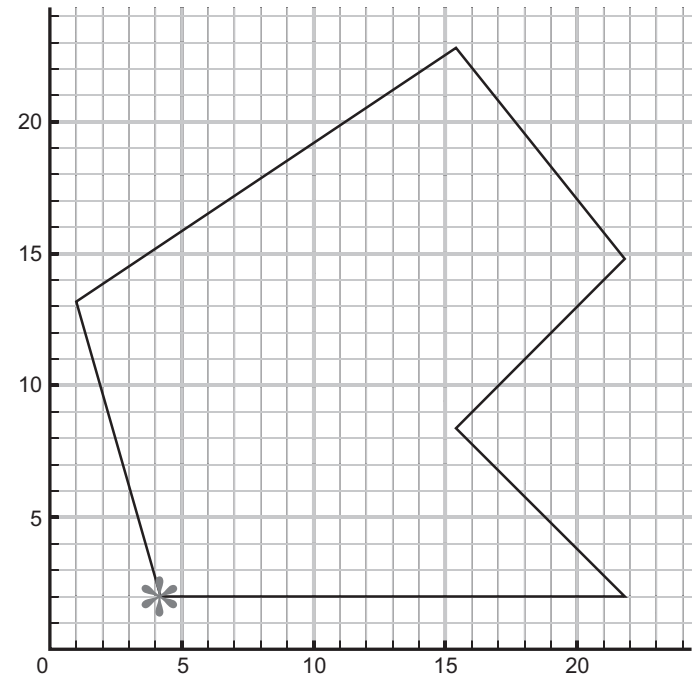


| x | y |
|----|----|
| 3 | 2 |
| 1 | 9 |
| 10 | 15 |
| 14 | 10 |
| 10 | 6 |
| 14 | 2 |
| 3 | 2 |

Scaling factor: 1.6

| x | y |
|------|------|
| 4.2 | 2 |
| 1 | 13.2 |
| 15.4 | 22.8 |
| 21.8 | 14.8 |
| 15.4 | 8.4 |
| 21.8 | 2 |
| 4.2 | 2 |

$x_{\min} = 1, y_{\min} = 2$



Polygon Overlay

